CLAIMS

WHAT IS CLAIMED IS

1. A fuel cell system comprising:

a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction;

a concentration detector arranged to detect a concentration of the fuel aqueous solution to be supplied to the fuel cell stack;

a temperature detector arranged to detect a temperature of the fuel cell stack;

an input amount determining device arranged to determine an amount of fuel to be inputted to the fuel aqueous solution based on the concentration of the fuel aqueous solution detected by the concentration detector and the temperature of the fuel cell stack detected by the temperature detector; and

an input device arranged to input the determined amount of the fuel to the fuel aqueous solution.

2. The fuel cell system according to Claim 1, wherein

the input amount determining device includes:

a memory arranged to store data which indicates a correspondence between the temperature of the cell stack and a target concentration of the fuel aqueous solution;

a target concentration determining device arranged to determine a target concentration of the fuel aqueous solution by making reference to the data in the memory and based on the temperature of the fuel

cell stack detected by the temperature detector; and

an input fuel amount determining device arranged to determine an amount of fuel to be input based on the concentration of the fuel aqueous solution detected by the concentration detector and the target concentration determined by the target concentration determining device.

3. The fuel cell system according to Claim 2, further comprising a target temperature raise time setting device arranged to set a target temperature raise time which indicates a time that is necessary for increasing the fuel cell stack to a predetermined temperature, wherein

the data in the memory includes data which indicates a correspondence between the temperature of the fuel cell stack, the target temperature raise time and the target concentration,

the target concentration determining device determines the target concentration of the fuel aqueous solution by making reference to the data and based on the temperature of the fuel cell stack detected by the temperature detector and the target temperature raise time set by the target temperature raise time setting device.

4. The fuel cell system according to Claim 2, further comprising a secondary battery electrically connected with the fuel cell stack, and an electric-charge detector arranged to detect an amount of electric charge in the secondary battery, wherein

the data in the memory includes data which indicates a

correspondence between the temperature of the fuel cell stack, the amount of electric charge in the secondary battery and the target concentration,

the target concentration determining device determines the target concentration of the fuel aqueous solution by making reference to the data and based on the temperature of the fuel cell stack detected by the temperature detector and the amount of electric charge in the secondary battery detected by the electric-charge detector.

5. The fuel cell system according to Claim 1, further comprising an ambient temperature detector arranged to detect an ambient temperature, wherein the input amount determining device corrects the determined amount of input of the fuel based on a difference between the temperature of the fuel cell stack and the ambient temperature.

6. The fuel cell system according to one of Claims 2 through 5, wherein the memory stores historical information about the concentration of the fuel aqueous solution, the concentration of the fuel aqueous solution being obtained from the historical information upon failure in detecting the concentration of the fuel aqueous solution by the concentration detector.

7. The fuel cell system according to Claim 6, wherein the historical information includes power generation data which indicates whether or not power generation was successful in the previous system startup, final concentration data which indicates a final concentration of the

fuel aqueous solution detected by the concentration detector, and time data which indicates the time when the final concentration was detected by the concentration detector,

the concentration of the fuel aqueous solution being provided by the final concentration indicated by the final concentration data upon determination, based on the power generation data, that power generation was successful in the previous system startup, and determination, based on the time data, that a first predetermined time has not been lapsed since the detection of the final concentration.

8. The fuel cell system according to Claim 7, wherein the historical information further includes input information of the fuel, the amount of input of the fuel being determined based on the input information upon determination, based on the power generation data, that power generation was not successful in the previous system startup or determination, based on the time data, that the first predetermined time has been lapsed since the detection of the final concentration.

9. The fuel cell system according to Claim 8, wherein the amount of input of the fuel is provided by the predetermined amount upon determination, based on the input information, that a second predetermined time has passed since the previous input of the fuel, the amount of input of the fuel is zero upon determination, based on the input information, that the second predetermined time has not

passed since the previous input of the fuel.

10. A fuel cell system comprising:

a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction;

a concentration detector arranged to detect a concentration of the fuel aqueous solution to be supplied to the fuel cell stack;

a secondary battery electrically connected with the fuel cell stack;

an electric-charge detector arranged to detect an amount of electric charge in the secondary battery;

an input amount determining device arranged to determine an amount of input of the fuel to be inputted to the fuel aqueous solution based on the concentration of the fuel aqueous solution detected by the concentration detector and the amount of electric charge in the secondary battery detected by the electric-charge detector; and

an input device arranged to input the determined amount of fuel to the fuel aqueous solution.

11. A fuel cell system comprising:

a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction; and

an input device arranged to input fuel to the fuel aqueous solution which is supplied to the fuel cell stack, at an end of power generation.

12. The fuel cell system according to Claim 11, further comprising:

a concentration detector arranged to detect a concentration of the fuel aqueous solution at an end of the power generation;

a memory arranged to store data which indicates a correspondence between the concentration of the fuel aqueous solution and the amount of input of the fuel; and

an input amount determining device arranged to determine an amount of input of the fuel by making reference to the data in the memory and based on the concentration of the fuel aqueous solution detected by the concentration detector, wherein

the input device inputs the determined amount of the fuel.

13. The fuel cell system according to Claim 11, further comprising:

a concentration detector arranged to detect a concentration of the fuel aqueous solution at an end of the power generation;

an ambient temperature detector arranged to detect an ambient temperature at an end of the power generation;

a memory arranged to store data which indicates correspondence between the ambient temperature and a target concentration of the fuel aqueous solution;

a target concentration determining device arranged to determine a target concentration of the fuel aqueous solution by making reference to the data in the memory and based on an ambient temperature detected by the ambient temperature detector; and

an input fuel amount determining device arranged to determine an

amount of fuel to be input based on the concentration of the fuel aqueous solution detected by the concentration detector and the target concentration determined by the target concentration determining device,

wherein the input device inputs the determined amount of the fuel.

14. The fuel cell system according to Claim 12 or 13, wherein

the memory further stores final concentration data which indicates a final concentration of the fuel aqueous solution detected by the concentration detector,

the concentration of the fuel aqueous solution is provided by the final concentration indicated by the final concentration data stored in the memory upon failure by the concentration detector in detecting a concentration of the fuel aqueous solution at an end of power generation.

15. A fuel cell system comprising:

a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction;

a temperature detector arranged to detect a temperature of the fuel cell stack;

an input amount determining device arranged to determine an amount of fuel to be inputted to the fuel aqueous solution by a feedback control based on the temperature of fuel cell stack detected by the temperature detector so as to bring the temperature of the fuel cell stack to a target temperature; and

an input device arranged to input the determined amount of fuel to the fuel aqueous solution.

16. The fuel cell system according to Claim 15, wherein the input amount determining device detects a temperature difference for a predetermined amount of time based on the temperature of the fuel cell stack detected by the temperature detector, and determines the amount of input of the fuel based on the temperature difference.

17. The fuel cell system according to Claim 15, wherein the input amount determining device includes:

a memory arranged to store data which relates to a temperature raise reference gradient and to an amount of input of the fuel, corresponding to the temperature of the fuel cell stack;

a temperature raise gradient detector arranged to detect a temperature raise gradient based on the temperature of the fuel cell stack detected by the temperature detector; and

an fuel input amount determining device arranged to determine the amount of input of the fuel by making reference to the data in the memory and based on the temperature raise gradient detected by the temperature raise gradient detector.

18. The fuel cell system according to Claim 15, wherein the input amount determining device determines the amount of input of the fuel by a PID control based on a difference between the target temperature and the temperature of the fuel cell stack detected by the

temperature detector.

19. A transport equipment utilizing the fuel cell system according to one of Claims 1, 10, 11 and 15.

20. A control method for a fuel cell system including a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction, the method comprising1 the steps of:

detecting a concentration of the fuel aqueous solution to be supplied to the fuel cell stack;

detecting a temperature of the fuel cell stack;

determining an amount of fuel to be inputted to the fuel aqueous solution based on the detected concentration of the fuel aqueous solution and the detected temperature of the fuel cell stack; and

inputting the determined amount of the fuel to the fuel aqueous solution.

21. A control method for a fuel cell system including a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction, and a secondary battery which is electrically connected with the fuel cell stack, the method comprising the steps of:

detecting a concentration of the fuel aqueous solution to be supplied to the fuel cell stack;

detecting an amount of electric charge in the secondary battery;

determining an amount of fuel to be inputted to the fuel aqueous solution based on the detected concentration of the fuel aqueous solution and the detected amount of electric charge in the secondary battery; and

inputting the determined amount of the fuel to the fuel aqueous solution.

22. A control method for a fuel cell system including a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction, wherein

fuel is inputted to the fuel aqueous solution at an end of power generation in order to increase a concentration of the fuel aqueous solution which is to be supplied to the fuel cell stack.

23. A control method for a fuel cell system including a fuel cell stack which is supplied with a fuel aqueous solution and generates electric energy by electro-chemical reaction, the method comprising the steps of:

detecting a temperature of the fuel cell stack;

determining an amount of fuel to be inputted to the fuel aqueous solution by a feedback control based on the detected temperature of fuel cell stack so as to bring the temperature of the fuel cell stack to a target temperature; and

inputting the determined amount of the fuel to the fuel aqueous solution.